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COKE-OVEN ACCIDENTS IN THE UNITED STATES

DURING THE CALENDAR YEAR 1916

COMPILED BY

ALBERT H. FAY

WASHINGTON
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COKE-OVEN ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1916.

Compiled by ALBERT H. FAY.

INTRODUCTION.

Reports received from the operators of coke ovens show a slight increase in the number of fatalities and injuries during the year 1916 as compared with 1915. The number of men killed in 1916 was 45, as compared with 38 in 1915 and 45 in 1914. The total number of men reported employed for 1916 was 31,603, as compared with 31,060 in 1915. The fatality rate in 1915 (based on the number of 300-day workers) was 1.21 per 1,000; in 1916 it was 1.32. The injury rate in 1915 was 90.78 per 1,000 men employed; in 1916 it was 153.49.

The reports tabulated herein represent 68,796 ovens in operation, as compared with 55,112 in 1915. The average number of days active in 1916 was 324, as compared with 303 in 1915 and 286 in 1914. The accident figures thus collected may not be complete for the entire industry, but they are sufficiently representative to point out some of the principal hazards.

This is the second report published by the Bureau of Mines giving separate accident data for beehive and by-product ovens and indicating a greater hazard for the latter than the former.

ACKNOWLEDGMENTS.

The data presented in this paper were voluntarily supplied by the officials and managers of the coke companies at the request of the bureau, there being no law compelling coke operators to render a report. The bureau thanks the operators for their hearty cooperation and invites suggestions whereby the annual report of coke-oven accidents may be improved to best serve the industry. The author acknowledges the assistance rendered by W. W. Adams and L. Chenoweth, of the Bureau of Mines, in the preparation of the various tables.

FATALITY AND INJURY RATES ON A 300-DAY BASIS.

In the bureau's previous reports relating to accidents at coke ovens all fatality and injury rates were based on the number of men reported as employed. As all the plants do not operate the same

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number of days, all of the labor and accidents data submitted herein have been reduced to the equivalent of 300-day workers. A summary of the bureau's reports for 1913, 1914, and 1915 is included, which has also been reduced to the same basis, thus making possible true comparisons one year with another and also one State with another.

CLASSIFICATION OF INJURIES.

Many of the States now have compensation laws, and in order to conform with their classifications the bureau's classification of serious and slight injuries are on a 14-day (2-week) basis. The classification of injuries for 1916 is as follows:

Classification of injuries for 1916.

	Number injured.
1. Fatal	45
2. Serious (time lost, more than 14 days):	
(*a*) Permanent disability—	
Total	2
Partial	81
(*b*) Others	686
3. Slight (time lost, 1 to 14 days, inclusive)	4,468

Permanent total disability.—Loss of both legs or arms, one leg and one arm, total loss of eyesight, paralysis or other condition permanently incapacitating workman from doing any work of a gainful occupation.

Permanent partial disability.—Loss of one foot, leg, hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

STATISTICAL TABLES.

Table 1 shows the number of men killed and injured at coke ovens by causes, and the number killed and injured per 1,000 300-day workers for the years 1913 to 1916, inclusive.

Table 2 gives labor statistics for all coke ovens by States and years for 1913 to 1916, inclusive. It also shows the number of days of labor performed and the equivalent number of 300-day workers upon which fatality and injury rates, as shown in Table 1, have been calculated.

Table 3 shows the number of fatalities and number of injuries at coke ovens by States, together with the fatality and injury rates based on the equivalent number of 300-day workers.

Table 4 shows the number of ovens by States for which accidents were reported for the years 1913 to 1916. Table 5 shows the average number of days the coke ovens in each State were operated for each year under consideration. The average number of days operated by

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all coke ovens in the United States in 1916 was 324, as compared with 303 in 1915 and 286 in 1914. Table 6 shows the number of the widows and orphans from men being killed at coke ovens by States for the years 1913 to 1916, inclusive.

Table 7 shows the actual number of fatalities and injuries by causes for the four-year period, and also the percentage of fatalities and injuries due to each cause. It will be noted that of the total number of fatalities 38.51 per cent was due to various types of haulage systems, 12.07 per cent to falls of persons, and 7.47 per cent to burns. Coke-drawing machines and electricity are each responsible for 8.05 per cent of the fatalities.

Of the injuries 10.15 per cent is due to haulage systems, 14.12 per cent to falls of persons, 11.41 per cent to hand tools, 14.30 per cent to burns, and 45.11 per cent is classified as being due to other causes.

Tables 8 and 9 show fatalities and injuries by causes and by States for the year 1916, with a summary for previous years.

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TABLE 1.—**ALL COKE OVENS: Fatalities and injuries,** *by causes, during the years ended Dec. 31, 1913 to 1916.*

Cause.	Number killed.				Number injured.				Killed per 1,000 300-day workers.				Injured per 1,000 300-day workers.			
	1913	1914	1915	1916	1913	1914	1915	1916	1913	1914	1915	1916	1913	1914	1915	1916
Cars, larries, and motors	13	5	10	9	122	135	123	369	0.56	0.24	0.32	**0.26**	5.23	6.36	3.91	**10.81**
Railway cars and locomotives	7	9	4	10	150	71	139	189	.30	.42	.13	**.29**	6.43	3.34	4.42	**5.54**
Coke-drawing machines	6	4	2	2	60	71	96	189	.26	.19	.06	**.06**	2.57	3.34	3.06	**5.54**
Electricity	5	5	1	3	43	24	16	33	.21	.24	.03	**.09**	1.84	1.13	.51	**.97**
Falls of persons	4	6	4	7	341	314	387	764	.17	.28	.13	**.21**	14.61	14.78	12.32	**22.39**
Hand tools	.....	1	.....	.....	336	299	322	503	.....	.05	.....	.....	14.40	14.08	10.25	**14.74**
Suffocation from gases	1	.....	2	.....	27	11	17	16	.04	.....	.06	.....	1.16	.52	.54	**.47**
Burns	2	2	7	2	379	299	349	802	.09	.09	.22	**.06**	16.24	14.08	11.11	**23.51**
Gas explosions	(a)	(a)	(a)	.....	(a)	(a)	(a)	26	(a)	(a)	(a)	.....	(a)	(a)	(a)	**.76**
Other causes	8	13	8	12	1,056	965	1,403	2,346	.34	.61	.26	**.35**	45.25	45.43	44.66	**68.76**
Total	**46**	**45**	**38**	**45**	**2,514**	**2,189**	**2,852**	**5,237**	**1.97**	**2.12**	**1.21**	**1.32**	**107.73**	**103.06**	**90.78**	**153.49**

a Not segregated.

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TABLE 2.—**ALL COKE OVENS:** *Labor statistics, by States, for the years ended Dec. 31, 1913 to 1916.*

State.	Men employed.				Days of labor performed.				Number of 300-day workers (calculated).			
	1913	1914	1915	1916	1913	1914	1915	1916	1913	1914	1915	1916
Alabama	2,591	2,281	2,153	**3,470**	739,741	741,013	629,406	**1,130,697**	2,466	2,470	2,098	**3,769**
Colorado	575	458	527	**652**	159,067	124,704	145,120	**198,749**	530	416	484	**662**
Illinois	1,259	1,117	1,169	**1,468**	446,089	407,705	426,685	**537,288**	1,487	1,359	1,422	**1,791**
Indiana	(a)	(a)	1,218	**1,094**	(a)	(a)	444,570	**399,154**	(a)	(a)	1,482	**1,331**
Kentucky	465	456	627	**899**	64,246	138,105	192,596	**297,709**	214	460	642	**992**
New Mexico	(a)	(a)	(a)	**365**	(a)	(a)	(a)	**131,875**	(a)	(a)	(a)	**440**
Ohio	359	517	701	**1,475**	122,155	155,632	236,496	**450,776**	407	519	788	**1,503**
Pennsylvania	12,344	11,991	18,849	**14,778**	3,564,490	3,163,715	5,607,146	**4,663,903**	11,882	10,546	18,690	**15,546**
Tennessee	420	191	315	**390**	97,894	57,964	77,689	**118,027**	326	193	259	**393**
Virginia	995	884	1,220	**1,406**	232,509	219,779	268,840	**409,720**	775	733	896	**1,366**
Washington	(a)	(a)	80	**87**	(a)	(a)	25,707	**26,454**	(a)	(a)	86	**88**
West Virginia	1,840	1,408	1,178	**2,137**	486,681	341,773	323,646	**657,339**	1,622	1,139	1,079	**2,191**
Other States	3,497	3,010	3,023	**3,382**	1,087,990	1,021,869	1,046,575	**1,213,983**	3,627	3,406	3,489	**4,047**
Total	**24,345**	**22,313**	**31,060**	**31,603**	**7,000,862**	**6,372,259**	**9,424,476**	**10,235,674**	**23,336**	**21,241**	**31,415**	**34,119**

a Included in "Other States."

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TABLE 3.—***ALL COKE OVENS: Fatalities and injuries, by States, during the years ended Dec. 31, 1913 to 1916.***

State.	Killed.				Injured.				Number killed per 1,000 300-day workers.				Number injured per 1,000 300-day workers.			
	1913	1914	1915	**1916**	1913	1914	1915	**1916**	1913	1914	1915	**1916**	1913	1914	1915	**1916**
Alabama	3	5	6	**2**	534	302	509	**564**	1.22	2.02	2.86	**0.53**	216.55	122.27	242.61	**149.64**
Colorado	2	2	1	**1**	10	4	13	**13**	3.77	4.81	2.07	**1.51**	18.87	9.62	26.86	**19.64**
Illinois	2	3	2	**3**	589	419	449	**328**	1.34	2.21	1.41	**1.68**	396.10	308.31	315.75	**183.14**
Indiana	(a)	(a)	3	**4**	(a)	(a)	155	**514**	(a)	(a)	2.02	**3.01**	(a)	(a)	104.59	**386.18**
Kentucky	1	2	0	**1**	45	127	98	**305**	4.67	4.35	.....	**1.01**	210.28	276.09	152.65	**307.46**
New Mexico	(a)	(a)	(a)	**2**	(a)	(a)	(a)	**6**	(a)	(a)	(a)	**4.55**	(a)	(a)	(a)	**13.64**
Ohio	0	5	0	**0**	57	112	160	**337**	.....	9.63	.....	.....	140.05	215.80	203.05	**224.22**
Pennsylvania	28	21	16	**25**	564	567	844	**2,108**	2.36	1.99	.86	**1.61**	47.47	53.76	45.16	**135.60**
Tennessee	0	0	0	**0**	3	2	38	**64**	.....	.....	.....	.....	9.20	10.36	146.72	**162.85**
Virginia	1	2	2	**2**	8	9	10	**59**	1.29	2.73	2.23	**1.46**	10.32	12.28	11.16	**43.19**
Washington	(a)	(a)	0	**0**	(a)	(a)	34	**19**	(a)	(a)	.....	.....	(a)	(a)	395.35	**215.91**
West Virginia	1	1	0	**0**	29	34	28	**93**	.62	.88	.....	.....	17.88	29.85	25.95	**42.45**
Other States	8	4	8	**5**	675	613	514	**827**	2.21	1.17	2.29	**1.24**	186.10	179.98	147.32	**204.35**
Total	**46**	**45**	**38**	**45**	**2,514**	**2,189**	**2,852**	**5,237**	**1.97**	**2.12**	**1.21**	**1.32**	**107.73**	**103.06**	**90.78**	**153.49**

a Included in "Other States."

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TABLE 4.—***Number of Ovens*** *for which accidents were reported during 1913 to 1916.*

State.	1913	1914	1915	1916
Alabama	4,686	3,455	3,594	**5,179**
Colorado	1,975	1,418	1,388	**2,118**
Illinois	568	485	626	**626**
Indiana	(a)	(a)	790	**689**
Kentucky	876	705	874	**946**
New Mexico	(a)	(a)	(a)	**980**
Ohio	424	362	500	**950**
Pennsylvania	42,470	32,423	37,659	**43,622**
Tennessee	1,715	700	715	**859**
Virginia	2,863	2,032	1,842	**3,193**
Washington	(a)	(a)	228	**243**
West Virginia	7,603	4,692	3,715	**6,722**
Other States	4,346	3,623	3,181	**2,669**
Total	**67,526**	**49,895**	**55,112**	**68,796**

[a] Included in "Other States."

TABLE 5.—*Average number of days coke ovens operated, 1913 to 1916.*

State.	1913	1914	1915	1916
Alabama	286	325	292	**326**
Colorado	277	272	275	**305**
Illinois	354	365	365	**366**
Indiana	(a)	(a)	365	**365**
Kentucky	138	303	307	**331**
New Mexico	(a)	(a)	(a)	**361**
Ohio	340	301	337	**306**
Pennsylvania	289	264	297	**316**
Tennessee	233	303	247	**303**
Virginia	234	249	220	**291**
Washington	(a)	(a)	321	**304**
West Virginia	265	243	275	**308**
Other States	311	339	346	**359**
Total	**288**	**286**	**303**	**324**

[a] Included in "Other States."

TABLE 6.—*Widows and orphans due to fatal accidents at coke ovens, 1913 to 1916.*

State.	Widows.				Orphans.			
	1913	1914	1915	1916	1913	1914	1915	1916
Alabama	2	2	3	**2**	6	1	5	**2**
Colorado	1	0	0	**1**	2	0	0	**3**
Illinois	2	1	2	**1**	4	1	4	**0**
Indiana	(a)	(a)	3	**1**	(a)	(a)	5	**3**
Kentucky	0	0	0	**0**	0	0	0	**0**
New Mexico	(a)	(a)	(a)	**1**	(a)	(a)	(a)	**4**
Ohio	0	3	0	**0**	0	11	0	**0**
Pennsylvania	8	13	7	**12**	21	43	24	**42**
Tennessee	0	0	0	**0**	0	0	0	**0**
Virginia	0	1	1	**0**	0	1	3	**0**
Washington	(a)	(a)	0	**0**	(a)	(a)	0	**0**
West Virginia	0	1	0	**0**	0	0	0	**0**
Other States	4	4	3	**3**	3	12	1	**1**
Total	**17**	**25**	**19**	**21**	**36**	**69**	**42**	**55**

[a] Included in "Other States."

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TABLE 7.—*Causes of fatalities, with percentage due to each cause, during the 4-year period, 1913 to 1916.*

Cause.	Fatalities.		Injuries.	
	Number.	Per cent of total.	Number.	Per cent of total.
Cars, larries, and motors	37	21.27	749	5.86
Railway cars and locomotives	30	17.24	549	4.29
Coke-drawing machines	14	8.05	416	3.25
Electricity	14	8.05	116	.91
Falls of persons	21	12.07	1,806	14.12
Hand tools	1	.57	1,460	11.41
Suffocation from gases	3	1.72	71	.55
Burns	13	7.47	1,829	14.30
Gas explosions	0	.....	26	.20
Other causes	41	23.56	5,770	45.11
Total	**174**	**100.00**	**12,792**	**100.00**

TABLE 8.—***ALL COKE OVENS: Fatalities,*** *by causes and States, during the year ended Dec. 31, 1916.*

State.	Cars, larries, and motors.	Railway cars and locomotives.	Coke-drawing machines.	Electricity.	Falls of persons.	Hand tools.	Suffocation from gases.	Burns.	Gas explosions.	Other causes.	Total.
	1	2	3	4	5	6	7	8	9	10	
Alabama	.....	1	.....	.....	.....	.....	.....	.....	.....	1	2
Colorado	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
Illinois	.....	.....	1	.....	.....	.....	.....	1	.....	1	3
Indiana	.....	.....	.....	2	2	.....	.....	.....	.....	.....	4
Kentucky	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
New Mexico	.....	1	.....	.....	.....	.....	.....	.....	.....	1	2
Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Pennsylvania	5	6	1	1	3	.....	.....	.....	.....	9	25
Tennessee	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Virginia	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	2
Washington	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
West Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Other States	1	2	.....	.....	1	.....	.....	1	.....	.....	5
Total, 1916	**9**	**10**	**2**	**3**	**7**	.....	.....	**2**	.....	**12**	**45**
Total, 1915	10	4	2	1	4	.....	2	7	(a)	8	38
Total, 1914	5	9	4	5	6	1	.....	2	(a)	13	45
Total, 1913	13	7	6	5	4	.....	1	2	(a)	8	46

a Not segregated.

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TABLE 9.—***ALL COKE OVENS**: Injuries, by causes and States, during the year ended Dec. 31, 1916.*

State.	Cars, larries, and motors.	Railway cars and locomotives.	Coke - drawing machines.	Electricity.	Falls of persons.	Hand tools.	Suffocation from gases.	Burns.	Gas explosions.	Other causes.	Total.
	1	2	3	4	5	6	7	8	9	10	
Alabama	26	22	26	3	70	72	.....	103	.....	242	**564**
Colorado	2	1	.....	.....	.....	1	.....	.....	.....	9	**13**
Illinois	23	12	3	.....	40	18	1	63	7	161	**328**
Indiana	38	17	34	2	65	56	1	85	1	215	**514**
Kentucky	6	3	3	.....	31	27	.....	29	.....	206	**305**
New Mexico	.....	1	.....	.....	3	.....	.....	.....	.....	2	**6**
Ohio	24	21	15	1	36	16	.....	66	11	147	**337**
Pennsylvania	209	75	87	22	386	208	8	273	3	837	**2,108**
Tennessee	2	7	5	.....	4	10	.....	14	.....	22	**64**
Virginia	6	.....	2	.....	2	5	.....	30	.....	14	**59**
Washington	.....	.....	.....	.....	7	2	.....	1	.....	9	**19**
West Virginia	9	5	.....	1	9	5	.....	46	.....	18	**93**
Other States	24	25	14	4	111	83	6	92	4	464	**827**
Total, 1916	**369**	**189**	**189**	**33**	**764**	**503**	**16**	**802**	**26**	**2,346**	**5,237**
Total, 1915	123	139	96	16	387	322	17	349	(*a*)	1,403	**2,852**
Total, 1914	135	71	71	24	314	299	11	299	(*a*)	965	**2,189**
Total, 1913	122	150	60	43	341	336	27	379	(*a*)	1,056	**2,514**

a Not segregated.

ACCIDENTS AT BY-PRODUCT AND BEE-HIVE OVENS SEGREGATED.

The report for 1915 [a] gave for the first time a segregation of by-product and beehive oven accidents. The data in Tables 10 to 14, inclusive, segregate these two branches of the industry for 1916 and supplement the 1915 report. During 1916 18,570 men were employed at beehive ovens and 13,033 at by-product plants. The by-product ovens were active 357 days during the year, as compared with 300 days for the beehive ovens, hence the number of 300-day workers at the by-product plants is considerably in excess of the actual number of men employed. The number of men killed at beehive ovens was 24, whereas 21 were killed at by-product ovens.

Tables 11 and 12 show, respectively, the fatalities and injuries at by-product ovens by causes and by States for the year 1916. Table 13 shows the actual number of men employed and also the equivalent number of 300-day workers in each State. Table 14 shows the fatality and injury rates, by principal causes, per 1,000 300-day workers in parallel columns both for beehive and by-product ovens. The wide difference in these rates may be due in part to the manner of reporting accidents, as it is possible that the companies operating the by-product ovens are keeping somewhat better records and making fuller and more complete reports than are many of the operators of the beehive ovens.

[a] Fay, A. H., Coke-oven accidents in the United States during the calendar year 1915: Bureau of Mines, 1916, 18 pp.

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TABLE 10.—***Beehive*** *and* ***by-product*** *coke ovens: Men employed, fatalities, injuries, days worked, and ovens in operation, by States, during the year ended Dec. 31, 1916.*

BEEHIVE OVENS.

State.	Ovens in operation.	Days of labor performed.	Average days active.	Killed.	Injured.	Widows.	Orphans.
Alabama	4,436	468,603	282	1	162	1	1
Colorado	2,118	198,749	305	1	13	1	3
Kentucky	838	59,443	240	1	17	.....	.....
New Mexico	980	131,875	361	2	6	1	4
Ohio	205	19,308	311	0	25	.....	.....
Pennsylvania	41,370	3,460,322	302	17	1,456	9	39
Tennessee	848	88,827	287	0	6	.....	.....
Virginia	3,193	409,720	291	2	59	.....	.....
Washington	238	20,979	291	0	9	.....	.....
West Virginia	6,602	610,491	304	0	84	.....	.....
Other States	878	109,024	354	0	29	.....	.....
Total, 1916	**61,706**	**5,577,341**	**300**	**24**	**1,866**	**12**	**47**
Total, 1915	48,766	4,630,661	262	10	615	5	16

BY-PRODUCT OVENS.

Alabama	743	662,094	366	1	402	1	1
Illinois	626	537,288	366	3	328	1	.....
Indiana	689	399,154	365	4	514	1	3
Ohio	745	431,468	305	0	312	.....	.....
Pennsylvania	2,252	1,203,581	365	8	652	3	3
Other States	2,035	1,424,748	361	5	1,163	3	1
Total, 1916	**7,090**	**4,658,333**	**357**	**21**	**3,371**	**9**	**8**
Total, 1915	6,346	4,793,815	359	28	2,237	14	26
Grand total, 1916	**68,796**	**10,235,674**	**324**	**45**	**5,237**	**21**	**55**
Grand total, 1915	55,112	9,424,476	303	38	2,852	19	42

TABLE 11.—***Beehive*** *and* ***by-product*** *coke ovens: Fatalities, by causes and States, during the year ended Dec. 31, 1916.*

BEEHIVE OVENS.

State.	Cars, barnes, and motors.	Railway cars and locomotives.	Coke-drawing machines.	Electricity.	Falls of persons.	Hand tools.	Suffocation from gases.	Burns.	Gas explosions.	Other causes.	Total, 1916.	Total, 1915.
	1	2	3	4	5	6	7	8	9	10		
Alabama	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1	0
Colorado	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1	1
Kentucky	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	0
New Mexico	.....	1	.....	.....	.....	.....	.....	.....	.....	1	2	0
Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Pennsylvania	4	3	1	.....	1	.....	.....	.....	.....	8	17	9
Tennessee	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Virginia	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	0
Washington	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
West Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Other States	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Total, 1916	**7**	**5**	**1**	.....	**2**	.....	.....	.....	.....	**9**	**24**	.....
Total, 1915	6	1	1	.....	1	.....	.....	.....	(a)	1	.....	10

BY-PRODUCT OVENS.

Alabama	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	6
Illinois	.....	.....	1	.....	.....	.....	.....	1	.....	1	3	2
Indiana	.....	.....	.....	2	2	.....	.....	.....	.....	.....	4	3
Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0
Pennsylvania	1	3	.....	1	2	.....	.....	.....	.....	1	8	7
Other States	1	2	.....	.....	1	.....	.....	1	.....	.....	5	10
Total, 1916	**2**	**5**	**1**	**3**	**5**	.....	.....	**2**	.....	**3**	**21**	.....
Total, 1915	4	3	1	1	3	.....	2	7	.....	7	.....	28
Grand total, 1916	**9**	**10**	**2**	**3**	**7**	.....	.....	**2**	.....	**12**	**45**	.....
Grand total, 1915	10	4	2	1	4	.....	2	7	(a)	8	.....	38

a Not segregated.

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TABLE 12.—***Beehive*** *and* ***by-product*** *coke ovens: Injuries, by causes and States, during the year ended Dec. 31, 1916.*

BEEHIVE OVENS.

State.	Cars, larries, and motors.	Railway cars and locomotives.	Coke-drawing machines.	Electricity.	Falls of persons.	Hand tools.	Suffocation from gases.	Burns.	Gas explosions.	Other causes.	Total, 1916.	Total, 1915.
	1	2	3	4	5	6	7	8	9	10		
Alabama	17	12	5	.....	18	21	.....	23	.....	66	**162**	66
Colorado	2	1	.....	.....	.....	1	.....	.....	.....	9	**13**	13
Kentucky	4	.....	1	.....	3	6	.....	.....	.....	3	**17**	16
New Mexico	.....	1	.....	.....	3	.....	.....	.....	.....	2	**6**	(a)
Ohio	5	.....	2	.....	1	1	.....	4	.....	12	**25**	1
Pennsylvania	187	50	76	19	296	143	.....	164	.....	521	**1,456**	469
Tennessee	.....	.....	.....	.....	1	1	.....	4	.....	.....	**6**	0
Virginia	6	.....	2	.....	2	5	.....	30	.....	14	**59**	7
Washington	.....	.....	.....	.....	4	2	.....	.....	.....	3	**9**	7
West Virginia	9	4	.....	1	8	2	.....	45	.....	15	**84**	19
Other States	.....	.....	.....	.....	2	.....	.....	.....	.....	27	**29**	17
Total, 1916	**230**	**68**	**86**	**20**	**338**	**182**	.....	**270**	.....	**672**	**1,866**	.....
Total, 1915	54	26	41	4	124	66	.....	55	(b)	245	.....	615

BY-PRODUCTS OVENS.

Alabama	9	10	21	3	52	51	.....	80	.....	176	**402**	443
Illinois	23	12	3	.....	40	18	1	63	7	161	**328**	449
Indiana	38	17	34	2	65	56	1	85	1	215	**514**	155
Ohio	19	21	13	1	35	15	.....	62	11	135	**312**	159
Pennsylvania	22	25	11	3	90	65	8	109	3	316	**652**	375
Other States	28	36	21	4	144	116	6	133	4	671	**1,163**	656
Total, 1916	**139**	**121**	**103**	**13**	**426**	**321**	**16**	**532**	**26**	**1,674**	**3,371**	.....
Total, 1915	69	113	55	12	263	256	17	294	(b)	1,158	.....	2,237
Grand total, 1916	**369**	**189**	**189**	**33**	**764**	**503**	**16**	**802**	**26**	**2,346**	**5,237**	.....
Grand total, 1915	123	139	96	16	387	322	17	349	(b)	1,403	.....	2,852

a Included in "Other States." b Not segregated.

TABLE 13.—***Beehive*** *and* ***by-product*** *coke ovens: Men employed, equivalent in 300-day workers, and fatalities and injuries, by States, during the year ended Dec. 31, 1916.*

BEEHIVE OVENS.

State.	Men employed.		Killed	Injured.	Per 1,000 300-day workers.	
	Actual number.	Equivalent in 300-day workers.			Killed.	Injured.
Alabama	1,661	1,562	1	162	0.64	**103.71**
Colorado	652	662	1	13	1.51	**19.64**
Kentucky	248	198	1	17	5.05	**85.86**
New Mexico	365	440	2	6	4.55	**13.64**
Ohio	62	65	.....	25	.....	**384.62**
Pennsylvania	11,477	11,534	17	1,456	1.47	**126.24**
Tennessee	310	296	.....	6	.....	**20.27**
Virginia	1,406	1,366	2	59	1.46	**43.19**
Washington	72	70	.....	9	.....	**128.57**
West Virginia	2,009	2,035	.....	84	.....	**41.28**
Other States	308	363	.....	29	.....	**79.89**
Total, 1916	**18,570**	**18,591**	**24**	**1,866**	**1.29**	**100.37**
Total, 1915	17,699	15,436	10	615	.65	**39.84**

BY-PRODUCT OVENS.

Alabama	1,809	2,207	1	402	.45	**182.15**
Illinois	1,468	1,791	3	328	1.68	**183.14**
Indiana	1,094	1,331	4	514	3.01	**386.18**
Ohio	1,413	1,438	.....	312	.....	**216.97**
Pennsylvania	3,301	4,012	8	652	1.99	**162.51**
Other States	3,948	4,749	5	1,163	1.05	**244.89**
Total, 1916	**13,033**	**15,528**	**21**	**3,371**	**1.35**	**217.09**
Total, 1915	13,361	15,979	28	2,237	1.75	**140.00**
Grand total, 1916	**31,603**	**34,119**	**45**	**5,237**	**1.32**	**153.49**
Grand total, 1915	31,060	31,415	38	2,852	1.21	**90.78**

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TABLE 14.—*Beehive and by-product coke ovens: Fatalities and injuries per 1,000 300-day workers, by causes, 1915 and 1916.*

Cause.	Killed.[a]				Injured.[b]			
	1915		1916		1915		1916	
	Beehive.	By-product.	Beehive.	By-product.	Beehive.	By-product.	Beehive.	By-product.
Cars, larries, and motors	0.38	0.25	0.38	0.13	3.50	4.32	12.37	8.95
Railway cars and locomotives	.07	.19	.27	.32	1.68	7.07	3.66	7.79
Coke-drawing machines	.07	.06	.05	.07	2.66	3.44	4.63	6.63
Electricity	.....	.06	.....	.19	.26	.75	1.07	.84
Falls of persons	.07	.19	.11	.32	8.03	16.46	18.18	27.43
Hand tools	.....	.....	.....	.....	4.28	16.02	9.79	20.67
Suffocation from gases	.....	.12	.....	.....	.....	1.07	.....	1.03
Burns	.....	.44	.....	.13	3.56	18.40	14.52	34.26
Gas explosions	(a)	(a)	.....	.....	(a)	(a)	.....	1.68
Other causes	.07	.44	.48	.19	15.87	72.47	36.15	107.81
Total	**.65**	**1.75**	**1.29**	**1.35**	**39.84**	**140.00**	**100.37**	**217.09**

[a] For number of fatalities, see Table 11. [b] For number of injuries, see Table 12.

SAFETY IN COKE-OVEN OPERATIONS.

From the figures in the preceding tables, which show a nonfatal-accident rate of 217 per 1,000 at by-product ovens and 100 per 1,000 at beehive ovens, it seems there is a large field for the extension of safety measures at coke ovens. In this connection it does not seem out of place to quote a few paragraphs from a paper read at the November, 1916, meeting of the National Safety Council, by Kenneth M. Burr, safety inspector for the Illinois Steel Co., in which he gives details of what is being done to safeguard coke workers of that company. He says:

The liability for injury at coke plants is not great. Outside of the shops there is comparatively little moving machinery connected with coke-oven operations. It seems to be that at some plants this fact in itself has had a tendency to cause the operators to think that coke-oven operations do not require a great deal of safety work; and, therefore, after installing the usual mechanical safeguards (such as are required by the laws of the State) they have been inclined to consider that they have done all that is necessary. Regarding it as essentially a hand-labor operation, in which the safety of a workman depends entirely on himself, they have not done all they could to prevent accidents. With such a high accident rate in the industry it certainly is time that safety in coke-oven operations received the most earnest consideration.

In order to be assured of a knowledge of causes of injuries, I have made an analysis of the records of our own plant. As it employs between eight and nine hundred men and has a by-product department, including the recovery of benzol, I believe it is safe to assume that a statement of the causes of injuries at this plant is fairly indicative of the causes of accidents at all by-product plants.

LACK OF CARE.

Hand-labor accidents head the list with 35.54 per cent. Everyone agrees that hand-labor accidents are virtually all due to carelessness. A large percentage of injuries were burns of one kind or another. This is to be expected, of course, but further investigation showed that practically every injury due to burns would have

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been prevented had a proper amount of care been used. In fact, with the exception of the injuries to eyes due to flying particles, I was convinced that at least 90 per cent of the accidents were on account of a lack of care on the part of the injured workmen or to careless acts of others. Of course, in this connection, it is proper to state that our plant has been very active in seeking means by which conditions may be made as safe as possible. I hope it will be understood that this suggestion is not made in a spirit of self-praise nor of criticism of other plants. It is made only as a possible explanation of the fact that the statement of causes shows such a low percentage of accidents (6.63 per cent) due to machinery.

SOME OF THE SAFETY MEASURES EMPLOYED.

At the risk of seeming to give more importance to the matter of mechanical safeguarding than its relative importance merits, it may be well to mention a few of the provisions for safety at our plant. At the coal-unloading station derails are installed to prevent bumping cars on which unloading crews are working. As it is necessary for men at times to poke down the coal in the cars, steel platforms are provided at the sides of the tracks from which much of this work can be done and which furnish a safe and easy way for men to get onto and into cars. Cables are stretched across the hoppers. As the cables are not rigid, they allow the coal to pass through readily and at the same time accomplish their purpose of preventing men from falling into the hoppers. Wrenches for use in opening the doors of the hopper cars are so made that if, when the ratchet dog is released and the pressure of coal upon the doors causes the shaft to spin, the wrench will automatically release. Open lights are not allowed in the crusher buildings or in the coal-conveyor inclosures. Provision is made by which, at any of a number of convenient places, the snapping of an electric switch will at once stop the conveyor. On the ovens the larry cars are equipped with fenders and automatic bells. The operator's cab is located so that he always has an unobstructed view ahead. The chutes on the cars are so constructed that when charging the ovens a hinged extension swings into place. This reduces to a minimum the amount of coal spilled around the charging hole. The lid men wear leggings, use a long-handled hook for removing lids, a long-handled broom for sweeping spilled coal into the ovens, and are, of course, instructed to work always on the windward side of the hole. The walks on both the pusher side and the coke side are wide. The coke is not quenched at the ovens but is taken in transfer cars to a quenching station, removed from the ovens. The quenching station structure is so inclosed that the steam is carried upward. This reduces the possibility of accidents due to steam-obstructed vision. These are but a few of the mechanical safeguards which are in addition to the stairways, walks, railings, gear guards, and other conventional safety provisions.

As it is shown that coke-oven accidents are not due to lack of physical protection, the conclusion is obvious that men employed in coke-oven operations must be very careless. The reason for this must be one of two things: Either it is because of labor conditions or because of a lack of proper education.

Now it is true that the work about the ovens is mostly of a routine nature. It does not require especial training or skill. Therefore there is a very large percentage of unskilled labor employed. At the same time the work is dirty, and about the ovens it is hot and unpleasant, especially in the summer months. Largely, as a result of these conditions, the percentage of change in operating forces is high. Accident rates are always high when and where there is a high percentage of new men. Safety in coke-oven operations, then, must begin with the employment of the men. The duty of the foremen in this regard can not be too strongly stated. Care in the selection of men can be made a great factor in assuring permanent forces.

Of course, the plants should be made safe along the lines of mechanical safeguards and safe working conditions. At the same time it is impossible to give too much

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attention to working conditions that affect the welfare and comfort of the men. As a suggestion along these lines I would call attention to the excessive heat on top of the ovens. It comes largely from the standpipes. I believe that it will be well to insulate them so that the amount of heat radiated will be reduced to a minimum. Water closets, urinals, wash and locker rooms, and shower baths should be provided. They should be convenient, light, and well ventilated, and, above all things should be kept clean. The mere providing of sanitary equipment is not sufficient—the equipment should be maintained in a manner to make it attractive and inviting. In short, one of the best ways to assure a permanent force is to make conditions as comfortable and attractive as possible.

EDUCATE THE WORKMEN.

Above all things, every effort should be exerted to educate the workmen into habits of caution. It is indispensable that every workman should be carefully instructed by his foreman regarding his work and the dangers attached to it. It is particularly necessary that the foreman should give complete instructions in safety to the non-English-speaking workman and that he take pains to be sure that the man fully understands and appreciates what has been told. He should insist that each man under him does his work as he has been instructed to do it. He should be held responsible for each accident that occurs to them and should thoroughly understand that he will be called upon to explain it. An effective means of education is that afforded by safety committees. But the fact that safety committees are active should under no circumstances be permitted to allow the foreman to forget his personal responsibility.

The most important function of the safety committee is to spread the gospel of safety, to impress upon each man that he must be careful at all times, that he must think and act safety. I believe that the most good can be secured by meetings held with groups of workmen. There can not be too many of these meetings. I think that it is highly important that written reports be made of each meeting. From these written reports much information is gotten which is of value to others. Most important, however, is the psychological effect on the man making it. He is of course anxious to state something of interest and to show that he is doing good work. This results in his really doing better work. The committeemen must be impressed with the frankness and sincerity of the management. The keynote of safety committee work must be "enthusiasm." No man can be enthusiastic in any work unless he believes it is right. There must be no doubt of it in his mind. Committees should work with the spirit of cooperation. Each member should be made to feel that he must plan and work for the prevention of accidents because it is right for him to be his "brother's keeper," and not from expectation of reward other than the satisfaction of a good work well done. But at the same time he must be made to feel that the eyes of his operating superiors are on him and that his efficiency in getting safety results will please his boss.

PERSONAL WORK OF SUPERINTENDENT.

As to the attitude of the operating head of the plant it is absolutely necessary that he must put all the power of his position and all the force of his personality behind the demand for accident prevention. If he is inclined to delegate safety matters to others and is not willing to take an active personal interest in it, the results are sure to be disappointing. A safety-first movement without the push of the superintendent continually behind it is like a watch without a mainspring. He must impress upon his entire organization that he is sincere in his interest and that he will rigidly discipline those who fail to do their full duty in matters regarding safety.

I believe we have a very good safety committee organization in our coke-oven department. It is a big department and has a large number of foremen. There is a

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general safety committee which meets once a week. This committee is a sort of a ways-and-means committee. They held 59 meetings during the first nine months of this year. The day following the meetings of this committee there is a meeting of what is called the "booster" committee. This committee consists of foremen. They discuss conditions, especially considering the matters to which their attention has been called by the general committee. They decide what shall be talked about in the meetings with the workmen. Each "booster" during the week gets together the members of his group. The group consists of 5 to 10 workmen, who are selected because of their ability to talk to the men. Each "booster" instructs the members of his group and the members of the group in turn hold meetings with the other workmen. This is a sort of an endless-chain scheme and works very successfully. There were 2,696 of these meetings, of which written reports were made during the first nine months of this year.

Education in safety naturally begins with telling men of things to be avoided, with instructions as to the safe way of working. But there is a broader field for this work. It is the duty of those who, either by endowment of nature or through better opportunities of education or training, have superior reasoning powers to teach those less fortunate to think for themselves—to do their best to get them to exercise their own powers of observation and to encourage them to develop and use their own reasoning powers. It is a duty they owe to themselves and to their fellow men.

I submit that safety in coke-oven operations calls for mechanical safeguarding, safe methods, care in the selection of workmen, agreeable surroundings, capable foremen, and, above all things, **education.**

PRODUCTION.

Table 15 shows the production of coke, and the amount of coal used in the coking industry, by States, during the years 1912 to 1915, inclusive. Table 16 shows the production of coke in the United States from 1850 to and including 1915, as reported by the United States Geological Survey. It also shows the value of coke at the ovens, the percentage of coke yield, and the number of ovens active in recent years.

TABLE 15.—*The amount of coal used for coking purposes and the amount of coke produced, by States.*[a]

[Short tons, 2,000 pounds.]

	1912		1913		1914		1915	
	Coal used.	Coke produced.	Coal used.	Coke produced.	Coal used.	Coke produced.	Coal used.	Coke produced.
Ala.	4,585,498	2,975,489	5,218,323	3,323,664	4,678,196	3,084,149	4,695,938	3,071,811
Colo.	1,473,112	972,941	1,349,743	879,461	1,048,251	666,083	1,026,019	670,938
Ill.	2,316,307	1,764,944	2,481,198	1,859,553	1,932,132	1,425,108	2,335,933	1,686,998
Ind.	3,198,874	2,616,339	3,535,136	2,727,025	3,125,207	2,276,652	3,685,774	2,768,099
Ky.	307,162	191,555	512,245	317,084	672,624	443,959	799,847	526,097
N. Mex.	679,209	413,905	788,172	467,945	660,501	362,572	732,830	389,411
Ohio.	561,426	388,669	507,417	351,846	745,097	521,638	985,471	684,658
Pa.	41,268,532	27,438,693	43,195,801	28,753,444	30,286,961	20,258,393	38,273,744	25,622,862
Tenn.	685,861	370,076	694,085	364,578	487,446	264,127	465,865	256,973
Va.	1,555,969	967,947	2,015,259	1,303,603	1,319,901	780,984	995,396	629,807
Wash.	78,693	49,260	118,786	76,221	133,349	84,923	204,879	136,552
W. Va.	4,061,702	2,465,986	4,034,251	2,472,752	2,316,309	1,427,962	2,273,763	1,391,446
Other States	4,805,517	3,367,794	4,788,774	3,402,354	4,217,776	2,959,304	5,357,439	3,745,498
Total.	**65,577,862**	**43,983,599**	**69,239,190**	**46,299,530**	**51,623,750**	**34,555,914**	**61,832,898**	**41,581,150**
Value.	$86,918,952	$111,805,113	$100,561,439	$128,922,273	$74,949,565	$88,334,217	$90,034,124	$105,503,868

[a] Compiled from Mineral Resources of the United States, U. S. Geol. Survey.

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TABLE 16.—*Statistics of the manufacture of* **coke** *in the United States, 1850–1916.*[a]

Year.	Number of ovens operated.			Coal used (short tons).	Coke produced (short tons).	Value of coke at ovens.	Price per ton at ovens.	Percentage yield of coal in coke.	Number employed.[b]
	Beehive.	By-product.	Total.						
1850[b]						$15,250			14
1860[b]						189,844			198
1870[b]						1,132,386			528
1880				5,237,741	3,338,300	6,631,267	$1.99	63.0	3,142
1881				6,546,662	4,113,760	7,725,175	1.88	63.0	
1882				7,577,648	4,793,321	8,462,167	1.77	63.0	
1883				8,516,670	5,464,721	8,121,607	1.49	64.0	
1884				7,951,974	4,873,805	7,242,878	1.49	61.0	
1885				8,071,126	5,106,696	7,629,118	1.49	63.0	
1886				10,688,972	6,845,369	11,153,366	1.63	64.0	
1887				11,859,752	7,611,705	15,321,116	2.01	64.0	
1888				12,945,350	8,540,030	12,445,963	1.46	66.0	
1889				15,960,973	10,258,022	16,630,301	1.62	64.0	8,938
1890				18,005,209	11,508,021	23,215,302	2.02	64.0	
1891				16,344,540	10,352,688	20,323,216	1.97	63.0	
1892				18,813,337	12,010,829	23,536,141	1.96	64.0	
1893		12		14,917,146	9,477,580	16,523,714	1.74	63.5	
1894		12		14,348,750	9,203,632	12,328,856	1.34	64.0	
1895		72		20,848,323	13,333,714	19,234,319	1.44	64.0	
1896		160		18,694,422	11,788,773	21,660,729	1.84	63.0	
1897		280		20,907,319	13,288,984	22,102,514	1.66	63.5	
1898		520		25,249,570	16,047,209	25,586,699	1.59	63.6	
1899	45,093	1,020	46,113	30,219,343	19,668,569	34,670,417	1.76	65.1	16,999
1900	41,954	1,085	43,039	32,113,553	20,533,348	47,443,331	2.31	63.9	
1901	60,231	1,165	61,396	34,207,965	21,795,883	44,445,923	2.04	63.7	
1902	65,461	1,663	67,124	39,604,007	25,401,730	63,339,167	2.49	64.1	
1903	75,379	1,956	77,335	39,423,525	25,274,281	66,498,664	2.63	64.1	
1904	74,111	2,910	77,021	36,531,608	23,661,106	46,144,941	1.95	64.8	18,981
1905	78,644	2,988	81,632	49,530,677	32,231,129	72,476,196	2.25	65.1	
1906	85,234	3,362	88,596	55,746,374	36,401,217	91,608,034	2.52	65.3	
1907	90,935	3,811	94,746	61,946,109	40,779,564	111,539,126	2.74	65.8	
1908	84,619	3,679	88,298	39,440,837	26,033,518	62,483,983	2.40	66.0	
1909		3,914	95,481	59,351,937	39,315,065	89,965,483	2.29	66.2	29,273
1910	92,016	4,051	96,067	63,088,327	41,708,810	99,742,701	2.39	66.1	
1911	59,160	4,320	63,480	53,278,248	35,551,489	84,130,849	2.37	66.7	
1912	67,847	5,211	73,058	65,577,862	43,983,599	111,805,113	2.54	67.1	
1913	66,477	5,531	72,008	69,239,190	46,299,530	128,922,273	2.78	66.9	
1914	49,496	5,142	54,638	51,623,750	34,555,914	88,334,217	2.56	66.9	
1915	48,985	6,036	55,021	61,832,898	41,581,150	105,503,868	2.54	67.2	
1916	65,605	6,607	72,212		54,533,585	170,841,197	3.13		

[a] Compiled from Mineral Resources, U. S. Geol. Survey.
[b] Compiled from Census Reports.

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